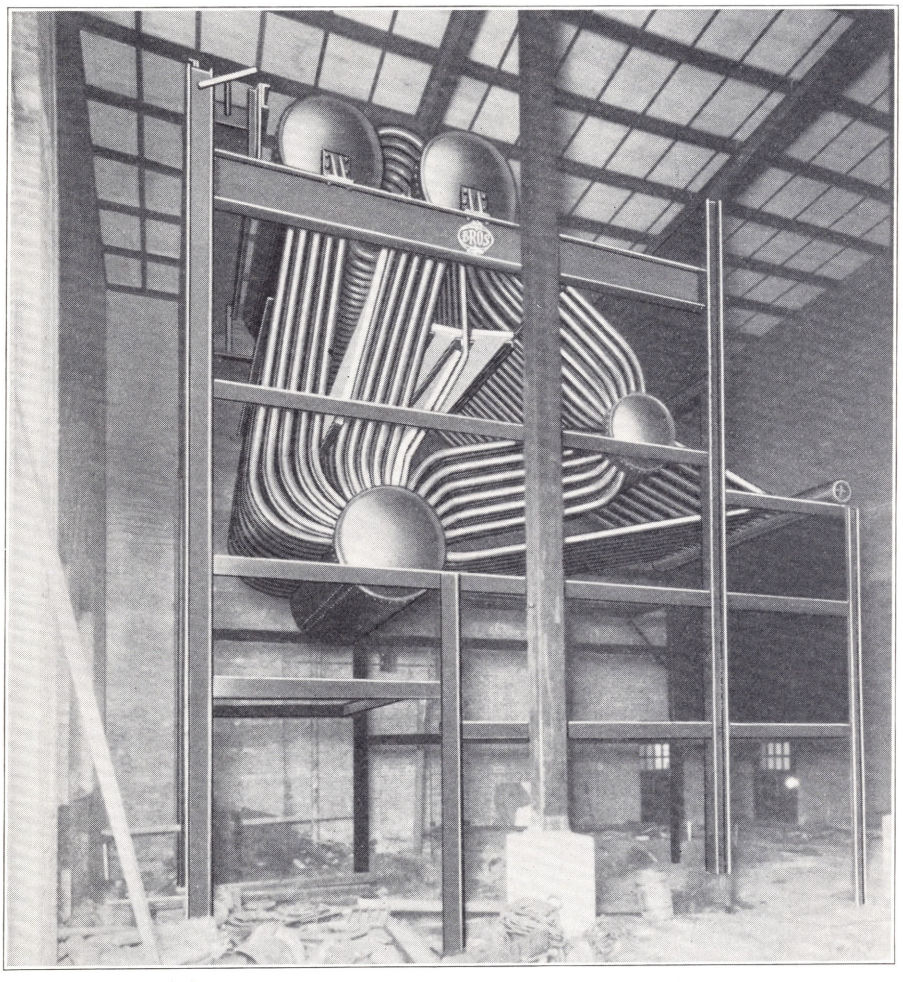
BROS-WETHERBEE WATERTUBE BOILERS

WM. BROS BOILER & MFG. CO.
MINNEAPOLIS, MINN.

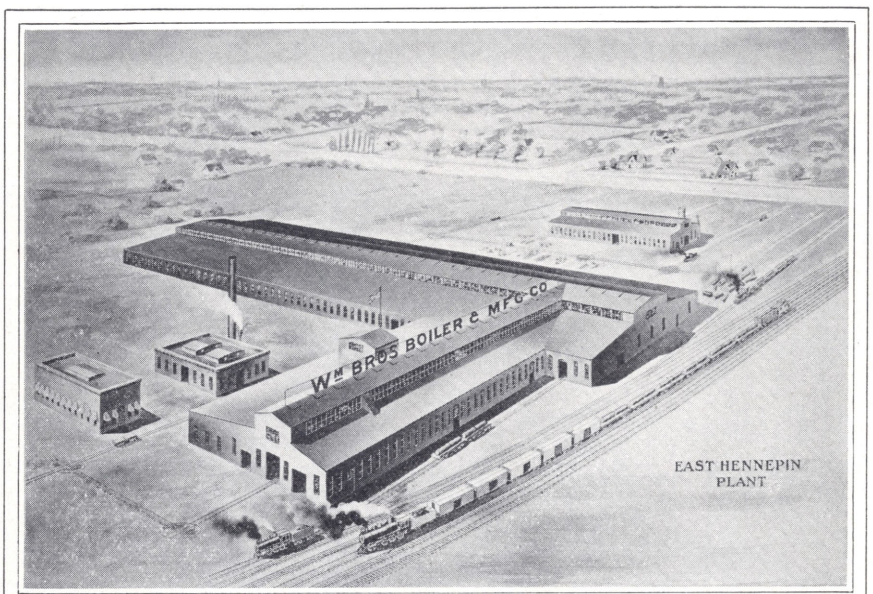
BENT TUBE WATERTUBE BOILERS



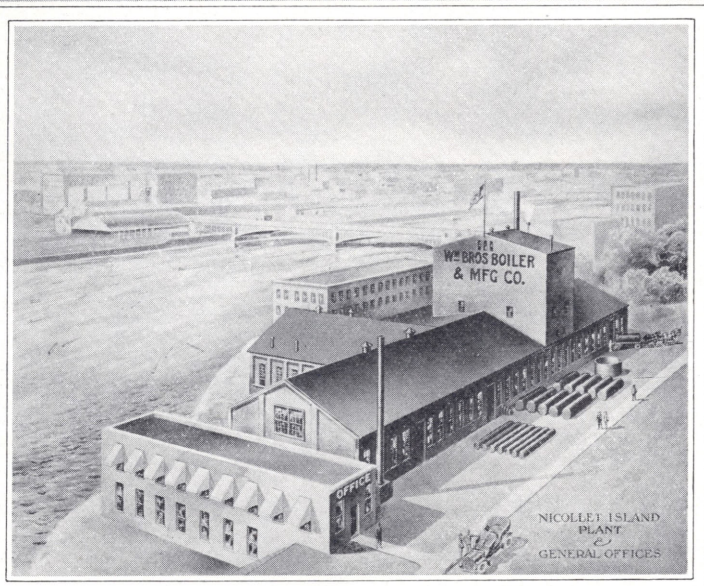
Wm. Bros Boiler and Manufacturing Company

1882-1928

Minneapolis, Minnesota



EAST HENNEPIN
PLANT



NICOLLET ISLAND
PLANT
&
GENERAL OFFICES

Wm BROS BOILER & MFG CO.

MINNEAPOLIS, MINN.

FOREWORD (Cont.)

This design also embodied an ideal location for a superheater in the direct path of the gases and only six or seven tubes removed from the furnace. An improved system of baffling removed all sliding joints.

These qualifications seemed to very closely approach the ideal boiler for which all engineers were striving, but before putting the new boiler on the market, several of its type were built and put into operation. Their operation and maintenance were exceptionally satisfactory.

So as a result of a number of years experience with, and investigation of, varying load and fuel conditions, the Wm. Bros Boiler & Manufacturing Company is offering this new boiler as a thoroughly tested and highly dependable product in a wide assortment of models and sizes—a boiler which they are confident will meet the most exacting conditions and measure up to the requirements of the most critical engineers.

FOUR DRUM BOILERS

No attempt has been made to cheapen this boiler to meet competition, but on the contrary, every feature has been planned and built to give the purchaser the utmost in service and satisfaction. Every function has been considered from the operator's viewpoint, and nothing left out or cheapened to detract from his complete satisfaction.

In the ensuing paragraphs frequent references to the line drawing on page 10 will assist in clarifying the various points brought out.

Circulation

This bent tube boiler is of the Ring Flow Type. *This design insures a positive and rapid circulation under all loads.* The feed water is distributed evenly over the bottom of the upper rear drum by means of an open-end perforated pipe, then it proceeds slowly down the economizer bank of tubes and is pulled into the rapid circulation of the Ring Flow. *Unrestricted circulation of this nature insures: First, High percentages of overload possible for long periods of time; and second, Reduces boiler maintenance to a minimum; third, Increases the efficiency by sweeping the steam bubbles rapidly away from the inner tube surface, thereby reducing their insulating effect.*

Gas Travel

This method of baffling reduces dead pockets in the gas travel to the absolute minimum. Consequently, all the available heating surface of the boiler takes an active part in the steam generation. The gas travel in the steam generation banks is crosswise to the tubes. *Cross-travel of gases relative to the heat absorbing element is scientifically recognized as the most efficient method of heat absorption. With this gas travel there is a continuous mixing of the gases between each row of tubes, so that different gas particles are constantly coming into contact with the tubes and giving up their heat. The resultant impingement of the gases due to this cross-travel tends to scour off the heat resisting gas film which surrounds each tube, thus permitting additional heat absorption.*

Steam Generation

This boiler has an exceptionally large area of heating surface in the steam generating portion of the boiler. *This gives rapid steam generation and ability to pick up the load instantaneously.*

This also precludes the possibility of reversal of circulation in the center bank of tubes, since more heat is absorbed in the preceding portion. In these boilers the

heat absorbed in the downward circulating center bank of tubes is entirely absorbed in the heat of the liquid, due to the increasing heat of the hydrostatic head, and rapid circulation.

Dry steam is secured at all loads by means of well-designed baffling in the steam drums. The reverse current steam separator principle is employed, which reverses the direction of flow abruptly, and causes a complete separation of steam and water.

The steam is baffled completely in the steam liberating drum before passing through the connecting tubes to the rear drum, thus securing commercially *dry steam* which is further purified of water by causing it to pass around under the lower edge of a plate in the rear drum, and thence up and into the top of a dry pipe. This thorough removal of water is sufficient for many uses, and where super-heaters are desired, this better drying increases the efficiency and capacity of the super-heaters. It also minimizes scaling in them, thus reducing their maintenance and increasing their life.

Economizer Bank Tubes

The boiler has a rear bank of tubes through which the feed water passes slowly downward before entering the main or ring flow circulation. These tubes function as a semi-economizer, included with the boiler, but avoiding the cost of operation associated with such units.

Low flue gas temperatures and a large volume of hot water for peak loads are made possible by this construction.

Feed Water

Under poor feed water conditions, the increasing temperature of the feed water as it descends in the economizer bank, causes a further precipitation of sediment and scale, similar to that occurring in the open heater. These impurities in the water are baffled into the lower part of the mud drum, and the sediment allowed to collect at the bottom. *They do not enter the main circulation.* The accumulated sediment can be taken off thru a large size blow-off.

Water Level

The Ring Flow, with its constant, even circulation, holds the water level steady under all loads. *Extra large drums, giving large steam release area and large water endurance surface, assist in obtaining steady water level.*

Baffling

The baffling of the boiler is simple and effective. The two primary or main baffles are plain tile, supported by the tubes and held in place by their own weight. The secondary or deflecting baf-

fles are cast iron, made sectionally, and can be changed to suit the draft. *There are neither sliding joints to maintain, nor brick walls supported on cast iron beams to sag or crack.*

Tubes

The tubes of the boiler are in horizontal and vertical lines, and are spaced on the horizontal alternately wide and narrow, to allow the replacement of any tube without removing others. *Any tube can be taken out over the stoker or grates.* This permits the placing of coal bunkers, etc., at a much lower level, which allows the erection of coal handling and storage in many places otherwise impossible and in all cases reduces the cost of installation of both machinery and building.

Superheaters

The boiler is ideally designed for superheaters, as the accompanying prints indicate. *The superheater can be placed six or seven tubes from the fire, and any degree of superheat obtained.* Moderate heats can be obtained by locating the superheater outside the second bank of tubes.

Structure & Framework

The boilers are furnished with a complete steel framework, well braced and stayed. This supports not only the boiler proper, but also the stack or breeching so that no load or strain comes on the brickwork. Sufficient buckstays are furnished and framed into this structure, so as to properly stay the walls.

Temperature Strains

This boiler is so built and supported that no undue strains can come on any part due to contraction or expansion. The lower drums are free to move in both directions with temperature changes.

Fuels & Furnaces

The boiler is adapted to any type of fuel or furnace. Among our enthusiastic users are included those using chain grates, underfeed stokers, fuel oil, and wood refuse. For powdered coal or other comminuted fuel, we make the BROS water cooled self supporting arch and slag screen as shown on page 13. This is built integral with the boiler, and becomes part of its regular circulation. There are no restrictions to the free release of the steam. We also build and install the BROS Water Cooled Walls for the rear, side or front walls when desired.

Compactness

Without increasing the total number of tubes, but rather by a careful arrangement of the heating surfaces, which reduces the number of both the very short and the very long tubes, practically all of the tubes are of medium length. This facilitates clean-

ing and renewals, and results in a very compact design. In a fixed height, the saving due to this compactness can be utilized to gain greater furnace height, with increased furnace efficiency and smokelessness.

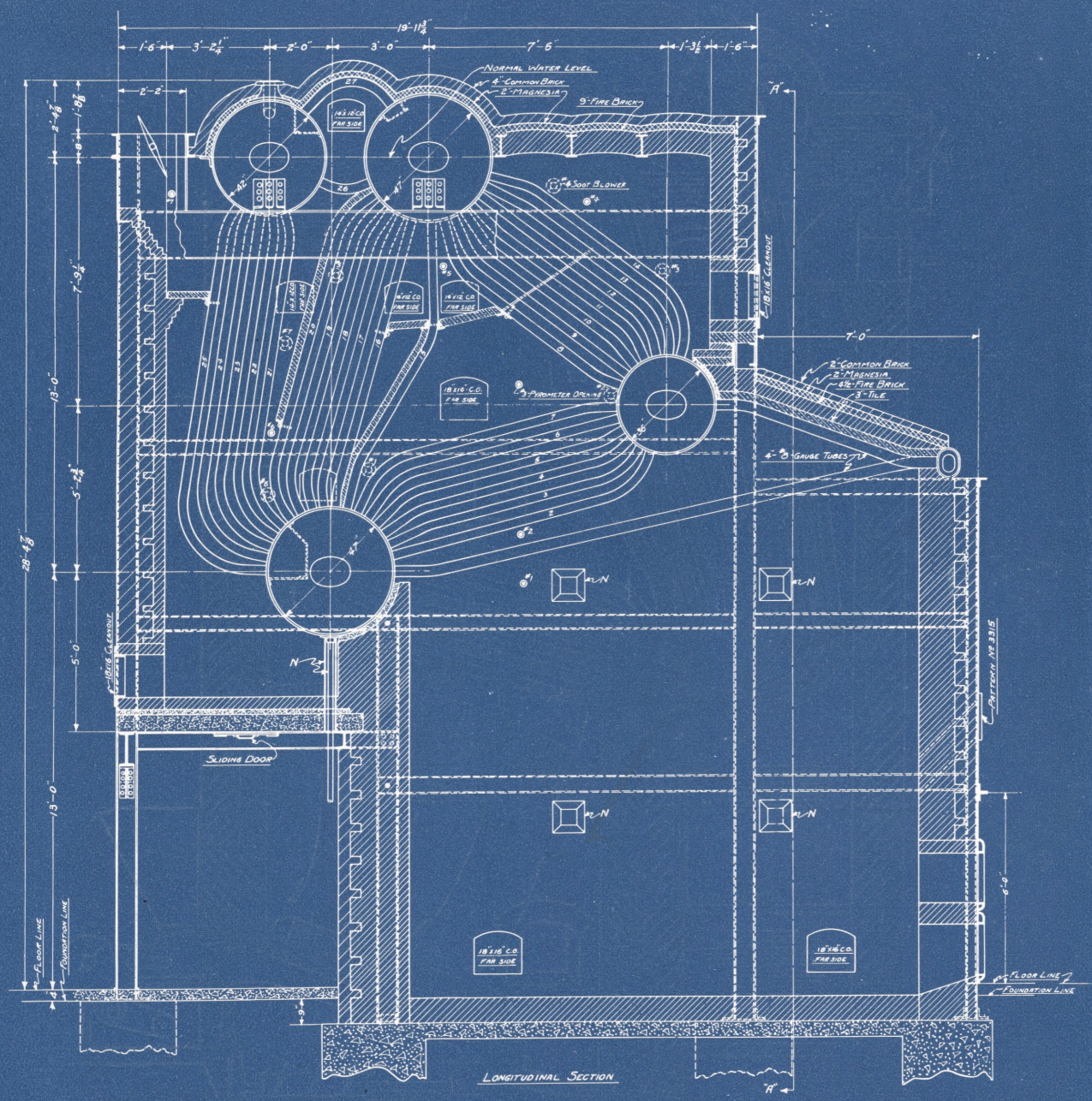
Adaptability

These boilers are made in nine different classes, varying mainly in height and horsepower per foot of width.

By a proper choice of these in various widths, a unit can be selected that will fit almost any requirements of head room and floor space.

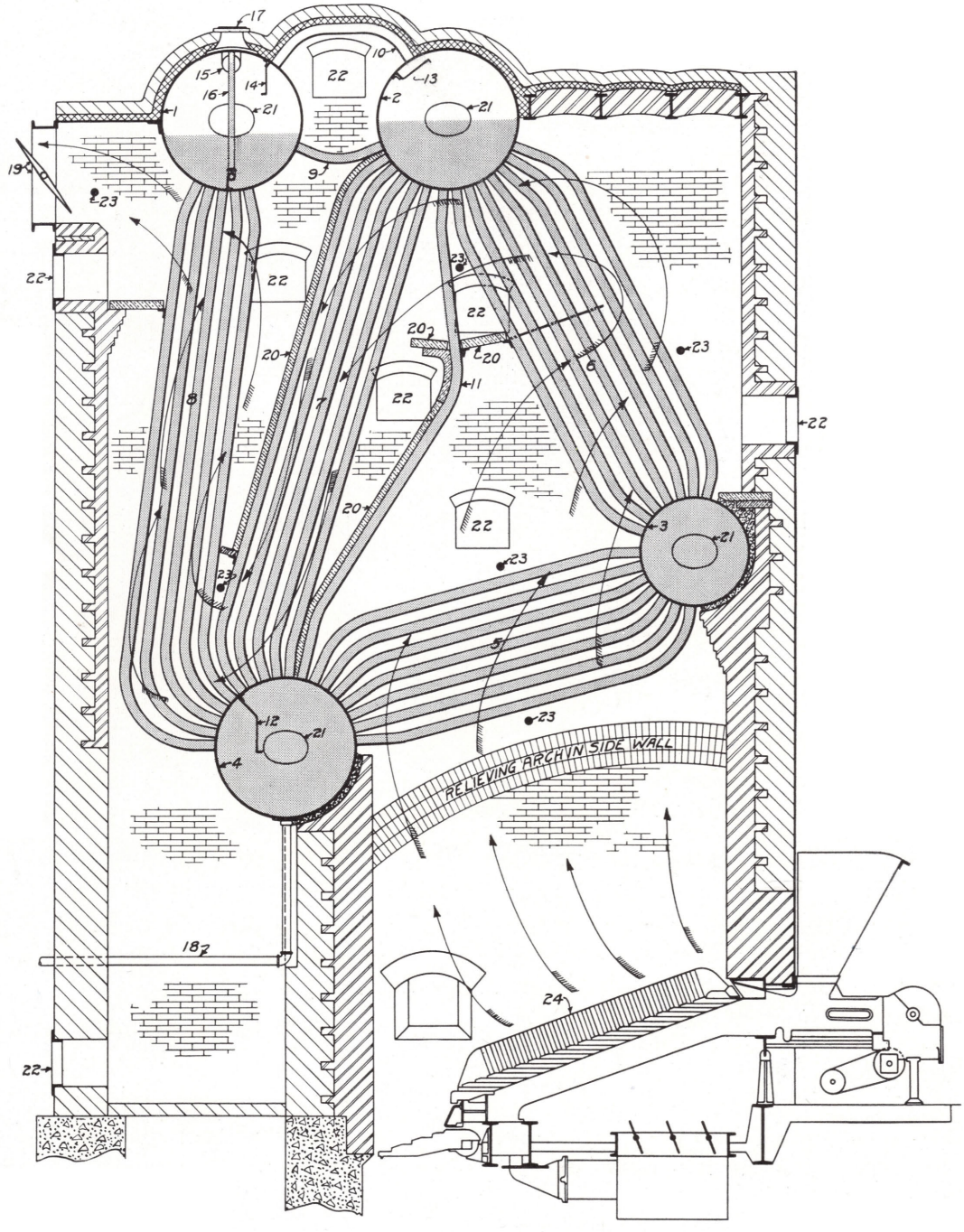
Efficiency

The high efficiency of our watertube boiler is obtained by: First, the furnace gases travel at right angles to the tubes. *This is the most efficient method of heat absorption.* Second, the furnace volume is correctly proportioned to the heating surface. *This insures complete combustion.* Third, the Ring Flow gives unrestricted and rapid circulation. *This gives quick steam release and good scrubbing action on the heating surface.* Last, the rear bank of tubes acts as an economizer. *This reduces the available heat content of the outlet furnace gases to a minimum.*



BROS - WETHERBEE BROS WATERTUBE BOILER

CLASS 43-18-S 400-H.P.
PULVERIZED COAL SETTING



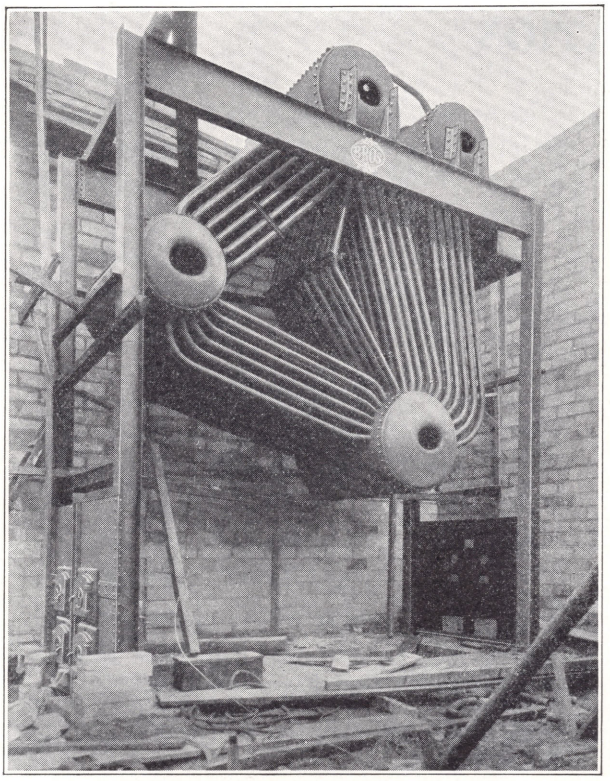
FOUR DRUM TYPE — CLASS 57

Ring flow circulation—Integral economizer—Bent tube—Crosswise travel of gases—Dry steam—Steady water level—Very compact—Ideal superheater location.

EXPLANATION

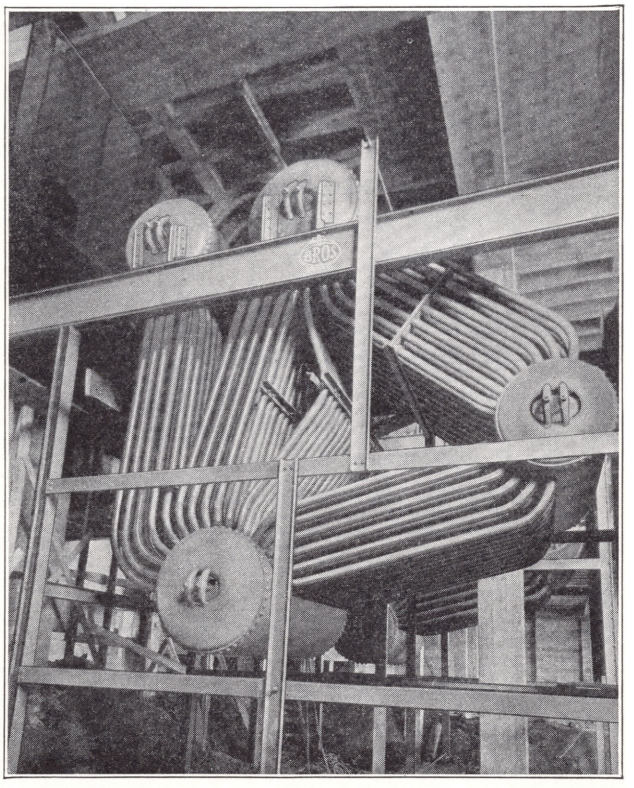
1. Steam Drum; exceptionally large, supported by cast steel brackets. The steam and safety valve outlets and the feed water inlet are in this drum.
2. Disengaging Drum; also supported by cast steel brackets. Exceptionally large, providing ample steam liberating surface and water endurance surface.
3. Submerged Drum; suspended from tube bank 6 and supported by bank 5 so that it is free to move as the tubes expand or contract.
4. Mud Drum; suspended from the tube banks 5, 7 and 8. This drum is also free to move as the tubes expand or contract.
5. First bank of tubes which receives the radiant heat and generates most of the steam. The space between banks 5 and 6 is an ideal location for superheaters.
6. Second tube bank of sufficient area to insure perfect circulation. Practically completes the steam generating element of the boiler. Note that gases sweep twice *across* the tubes of this bank.
7. Third tube bank of less area than banks 5 and 6 so that the speed of the water after the steam has been liberated will not be impaired, therefore the chance of scale and impurities adhering to the tubes is reduced to a minimum.
8. Rear or economizer tube bank where the feed water is heated with gases previous to exit, taking advantage of increased thermal head.
9. Equalizer tubes. This row of tubes is essential to maintain a constant water level between drums 1 and 2. This point has been neglected in many boilers of this type.
10. The steam liberated in drum 2 is conveyed to drum 1 by these tubes. These tubes with the aid of the baffles 13 and 14 absolutely insure dry steam.
11. This is a row of steam generating tubes bent to support the baffles thereby eliminating hollow girders and such complicated baffling.
12. This baffle guides the feed water into the quiet zone of the Mud Drum where sediment is deposited before entering the active circulation.
13. This baffle eliminates the water from the steam before it passes into the steam drum.
14. This baffle is an added insurance of dry steam since it must pass under this plate, and reverse its direction at low velocity.
15. Dry pipe is perforated on the top with drain in bottom.
16. Feed line runs the full width of the tubes giving an equal distribution of the water.
17. Forged steel steam nozzle.
18. Blow-off.
19. Damper and damper frame form part of framework and may be put either on top or rear of boiler.
20. Simple baffling, no ventilated girders or poured baffles.
21. 11''x15'' manhole openings.
22. Large clean-out doors.
23. Pyrometer openings in boiler walls.
24. Furnace can be arranged to accommodate any type of firing. The drawing illustrates a multiple retort stoker.

    Arrows indicate path of hot gases.



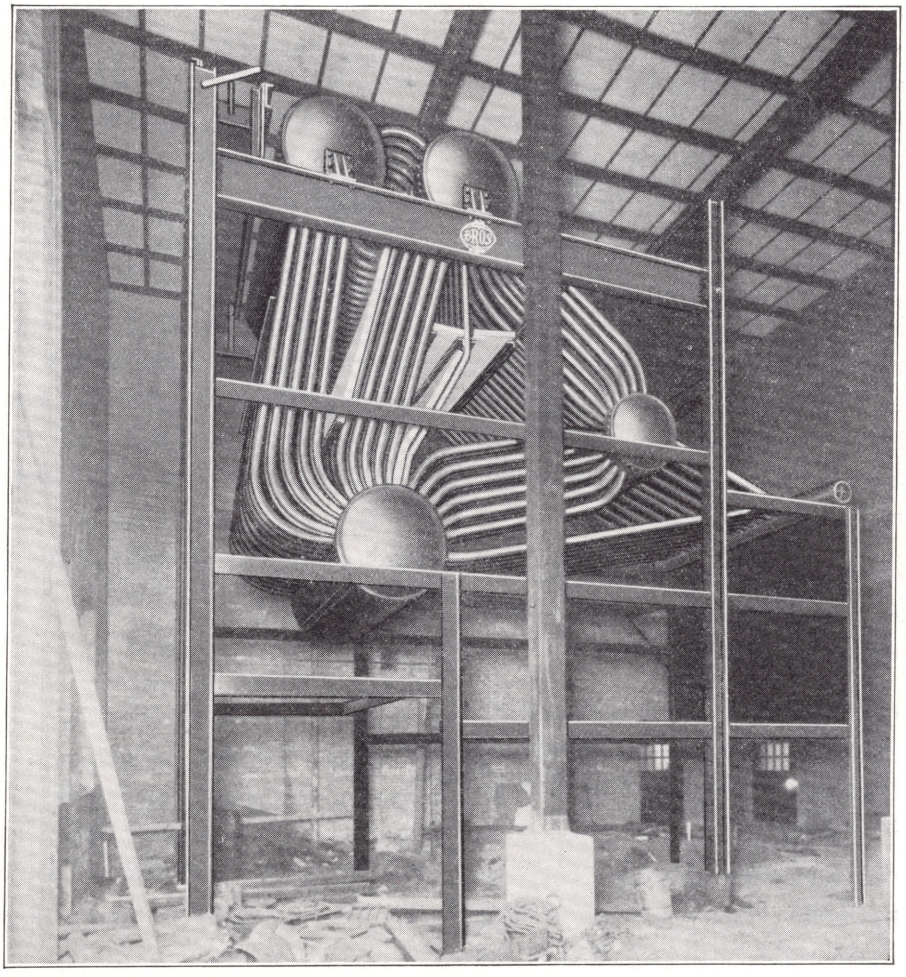
Class 40, 220 H. P., 199 lbs. W. P. for Naugle Pole & Tie Co., Minneapolis, Minn.

A Four Drum Boiler
Partially erected
regularly fired with oil
from rear, but with an
emergency coal front.



Sisters of the Order of St. Benedict Hospital, St. Cloud, Minn.

Two Four Drum Boilers, Class 41, 308 H. P., Each 195 lbs. W. P., stoker fired.



Four Drum boiler at the
Minneapolis Mfg. Co., Minneapolis

Class 43-S, 400 H. P., 198 lbs. W. P., stoker fired, could easily be adapted to pulverized coal.

Note that a slag screen of 4'' tubes takes the place of one row of tubes in the first bank.

THREE DRUM BOILERS

For installations too small for the economical installation of the four drum boilers, or where headroom is very limited, we furnish the *three drum* ring flow boiler.

Almost all of the advantages of the four drum boilers have been retained in these smaller units except the separate semi-economizer bank of tubes. A large part of the function of this has been retained by an internal plate, and an ingenious method of introducing the feed water.

The definitely controlled cross flow of gases, and the unrestricted ring flow give maximum heat absorption.

Any tube can easily be replaced, even in very restricted locations. All portions of the boiler are easily accessible for inspection or cleaning.

The baffling is very complete, but very much simplified. There are no sliding joints or brick walls on iron beams to sag or crack. It is designed so that there is the very minimum of maintenance, while repairs or replacements are very easy.

These three drum boilers are usually shipped completely assembled from our shop, eliminating field erection work. They are shipped already mounted on substantial skids, so that unloading and handling are easy, as may be seen from some of the cuts on succeeding pages.

They are furnished with a complete structural steel framework, shipped knock-down, but so designed and marked that it can be put in position and bolted together very easily. The damper box is an integral part of this frame, and built to carry the entire weight of the stack if desired without putting any load on the brickwork.

Our shop inspection is so severe that these boilers always arrive in perfect condition.

In the smaller, hand-fired sizes, these are very popular as replacements for return tubular boilers. With the low setting shown on page 20 they require the same headroom, and width, as the H. R. T. boiler, but they are about *five feet shorter* over all. No space for tube removal is required.

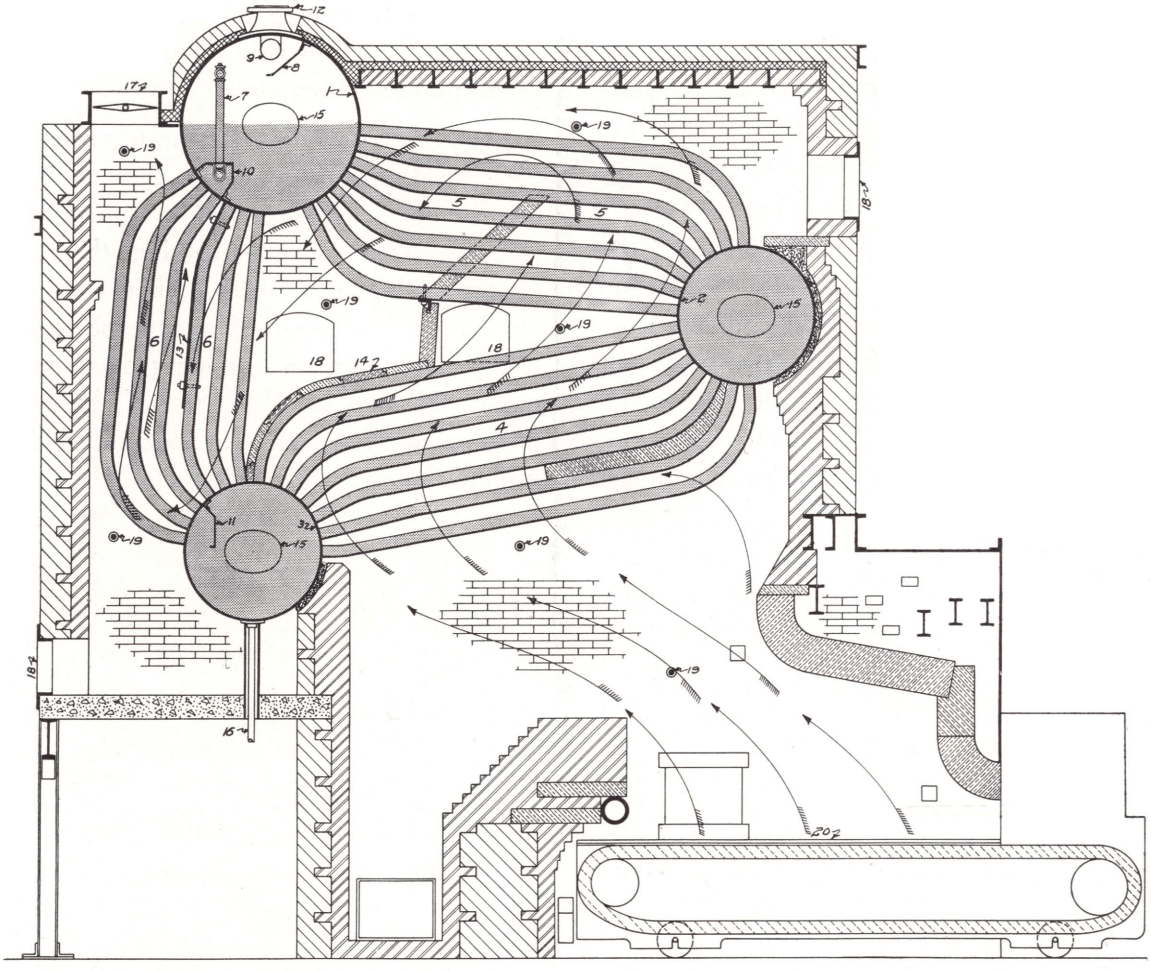
Thus for only a slightly increased cost, the advantages of a watertube boiler are available. The better heat absorption of the watertube boiler means a saving in the fuel cost, while the longer life and less repairs means a reduction in the overhead.

The settling out of the mud and sediment away from the heat of the fire, and the elimination of the girth seam in the

fire, are important advantages. The tube ends are in the water instead of exposed to the fire. Both sides of the heating surface are accessible for inspection and cleaning. If a tube should be burned or blistered, it is easily replaced and without necessitating any reduction in pressure. The free circulation makes these very rapid steamers, requiring very little time to get a cold boiler up to pressure.

The three drum boilers can be furnished for any pressure. They will deliver much more steam from a boiler of the same rating than a tubular boiler. Frequently the replacement of old tubular boilers with three drum watertube boilers will save an extension to the existing boiler room to meet enlarged demands.

In the new installations, or where sufficient headroom is available, these boilers are usually set higher, and equipped with stokers. This permits forcing them to higher ratings, for which they are extremely well adapted. Under these conditions, their greater capacity frequently makes the total installed cost of the complete plant *less* than for return tubular boilers.



THREE DRUM TYPE

For Low Headroom. No additional space is required for tube removal.

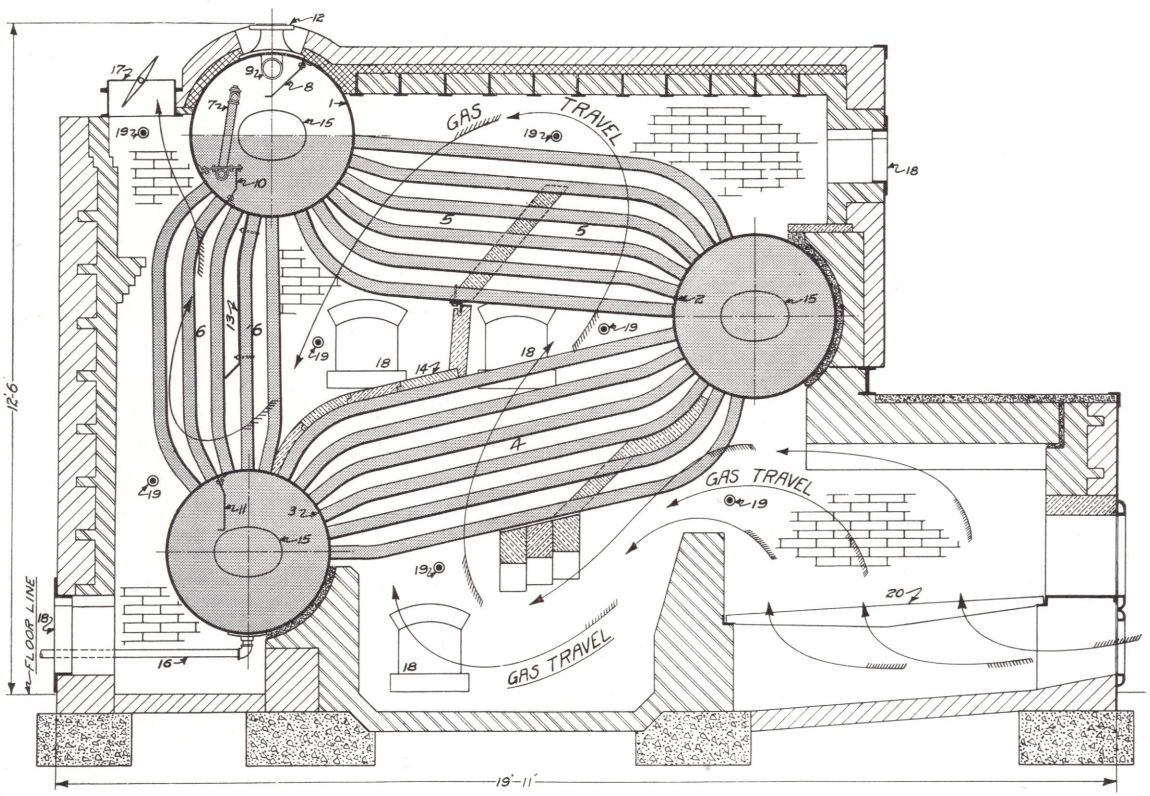
All parts of this boiler can be taken thru very small openings to sub-basements or to other almost inaccessible locations.

Explanation on the following page.

EXPLANATION

1. Steam Drum and Disengaging Drum; exceptionally large providing ample steam liberating surface and water endurance surface. The steam and safety valve outlets and the feed water inlet are in this Drum.
2. Submerged Drum; suspended by steel brackets.
3. Mud Drum; suspended from the tube banks 4 and 6 so that it is free to move as the tubes expand or contract.
4. First bank of tubes which receives the radiant heat and generates most of the steam. The gases sweep across the tubes of this bank carrying away the film of cool gas which tends to cling to the tubes and readily giving up their heat to the water.
5. Second tube bank of sufficient area to insure perfect circulation. This bank completes the steam generating element of the boiler. Note that the gases sweep *twice* across the tubes of this bank.
6. Third tube bank of less area than banks 4 and 5 so that the speed of the water after the steam has been liberated will not be impaired which reduces the chance of scale and impurities adhering to the tubes to a minimum.
7. Feed line runs the full width of the tubes giving an equal distribution of the water.
8. This baffle eliminates the water from the steam, since it must pass under this plate and reverse its direction at low velocity.
9. Dry pipe is perforated on the top, causing the steam to change its direction twice more and insuring dry steam. There are drain holes in the bottom.
10. This baffle keeps the feed water in the tubes that take the last pass of the gases, taking advantage of the increased thermal head.
11. This baffle guides the feed water into the quiet zone of the mud drum where sediment is deposited before entering the active circulation.
12. Forged steel steam nozzle.
13. Plain plate baffle supported and kept cool by the tubes.
14. Plain baffles with no hollow girders.
15. 11″x15″ manhole openings.
16. Blow-off.
17. Damper and Damper frame form part of structural supports of boiler and are designed to carry a guyed steel stack without putting any weight on the brickwork. May also be put on rear of boiler for breeching connection.
18. Large clean-out doors.
19. Pyrometer openings in boiler walls.
20. Furnace can be arranged to accommodate any type of firing.

Arrows indicate path of hot gases.



THREE DRUM TYPE

For Small Plants For Low Headroom

This type occupies the same height and width as a horizontal return tubular boiler of the same horse power but much less length. Moreover no additional space is required for tube removal.

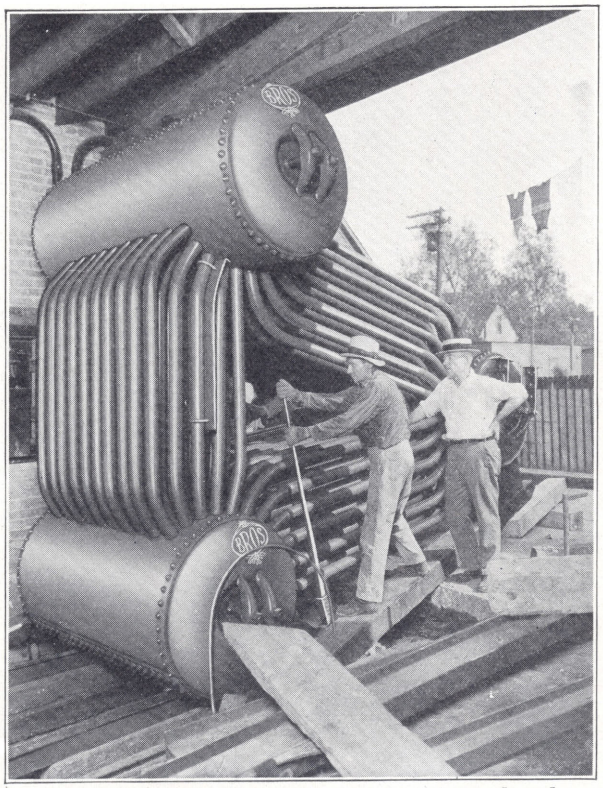
All parts of this boiler can be taken thru very small openings to sub-basements or to other almost inaccessible locations.

Explanation on page 17.

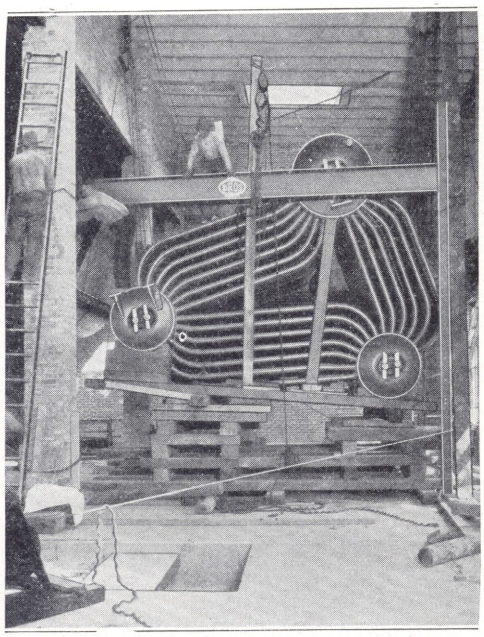
These boilers are made as small as 65 H. P.

BROS - WETHERBEE BROS WATERTUBE BOILER

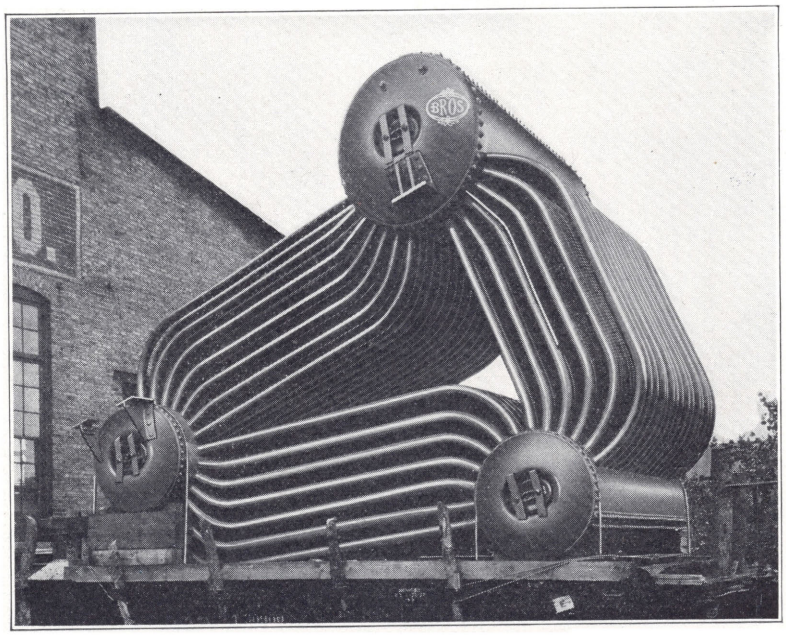
CLASS BB #10 100 H.P.
HAND FIRED SETTING



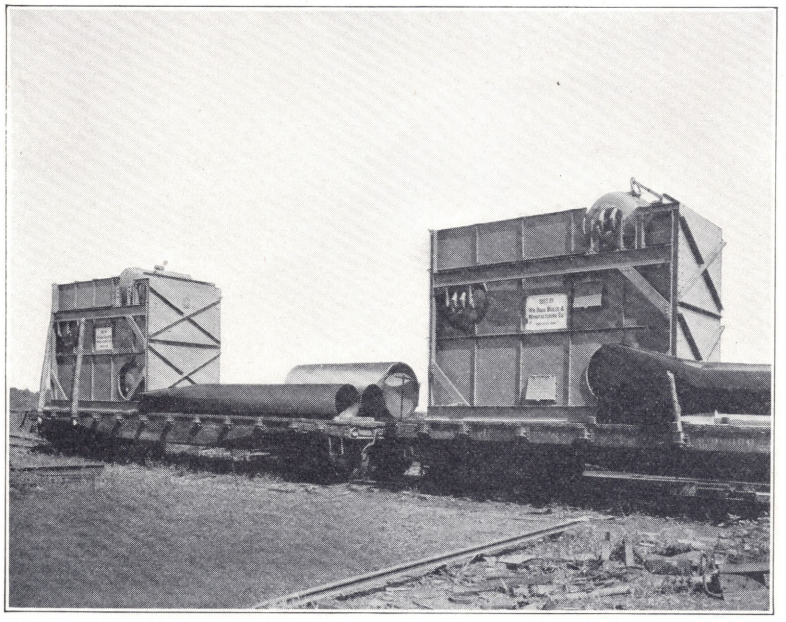
A Three Drum Boiler being moved through a low doorway. Class BB, 97 H. P., 140 lbs. W. P., hand fired, shipped to the Aristo Laundry, Chicago, Ill. Note ease of handling.



Above is one of two Class 32, 250 H. P., 150 lbs. W. P. boilers, stoker fired. Installed at the St. Nazareth Academy, La Grange, Ill.

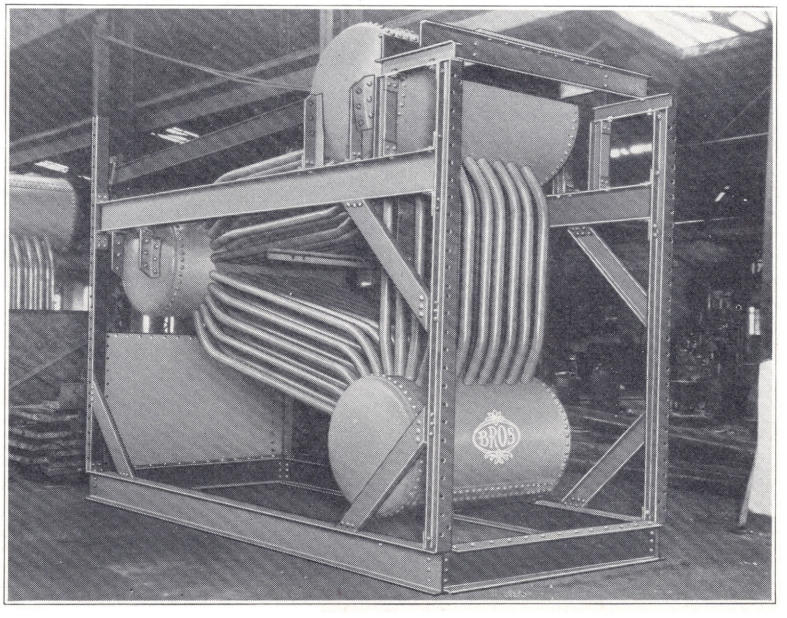


On the left is one of these boilers, showing skids which are put on in the shop and need not be removed until the boiler is in position.



Two shipments of steel cased Portable Three Drum Boilers. Class BB, 66 H. P., Each 125 lbs. W. P., to be gas fired. One for Independence Laundry, Independence, Kansas. One for Model Laundry, Bartlesville, Oklahoma.

A steel cased portable boiler being assembled on the erecting floor. Class BB, 66 H. P., 125 lbs. W. P., to be gas fired, for the Independence Laundry, Independence, Kansas.



Manufacturers of

Watertube Boilers, High and Low Pressure Return Tubular Boilers, Vertical Boilers, Hydro Pneumatic and Storage Tanks, Water Heating Garbage Burners, Water Heaters, Stacks and Breechings

The WM. BROS BOILER & MFG. COMPANY is always glad to furnish estimates on boilers and installations without cost or obligations.